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Experiment Station Work,

XXXVIII.

Compiled from the Publications of the Agricultural Experiment Stations.

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PARAFFIN IN DAIRYING.

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EXPERIMENT STATION WORK.

Edited by W. H. Beal and the Staff of the Experiment Station Record.

Experiment Station Work is a subseries of brief popular bulletins compiled from the published reports of the agricultural experiment stations and kindred institutions in this and other countries. The chief object of these publications is to disseminate thruout the country information regarding experiments at the different experiment stations, and thus to acquaint farmers in a general way with the progress of agricultural investigation on its practical side. The results herein reported should for the most part be regarded as tentative and suggestive rather than conclusive. Further experiments may modify them, and experience alone can show how far they will be useful in actual practise. The work of the stations must not be depended upon to produce "rules for farming." How to apply the results of experiments to his own conditions will ever remain the problem of the individual farmer.—A. C. True, Director, Office of Experiment Stations.

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EXPERIMENT STATION WORK.[a]

LOSS OF NITROGEN FROM SOILS.[b]

Nitrogen is the most expensive element of plant food as well as the one most easily lost from the soil. A fundamental basis of the best systems of farming is the increase and conservation of nitrogen in the soil. With certain systems of mixt farming in which an abundance of manure is produced and with rotations in which the nitrogen-gathering leguminous plants are freely used as green manures it is possible to maintain and even increase the nitrogen supply in the soil. With clean culture crops and continuous grain cropping, on the other hand, there is a continual drain upon the nitrogen supply of the soil, and as H. Snyder, of the Minnesota Station, has shown, there are large losses of this most important element and a resultant decline in the productive capacity of the soil.[c] It is becoming a matter of common observation that thruout the regions where grain has been grown continuously there is a general decline in nitrogen of the soil and a marked falling off in average yield.

Professor Snyder's experiments indicate "that the main loss of nitrogen is due to oxidation of the humus, of which nitrogen is one of the constituent elements, rather than to the removal of large amounts by the grain crops." As a result of the oxidation of the humus the nitrogen escapes into the air in the free gaseous form or is leached out in the drainage as nitrates.

A crop of wheat yielding 30 bushels per acre removes less than 40 pounds of nitrogen per year, but tests have shown that in twelve years of exclusive grain cultivation the loss of nitrogen in the case of rich soils has approximated 1,600 pounds per acre. Numerous analyses of soils that have been under cultivation for different periods have shown similar losses of nitrogen. * * *

The loss of nitrogen from four grain farms in ten years amounted to from three to five times more than was removed by the crops. This loss was due to the rapid decay of the humus and the liberation of the nitrogen, which forms an essential part of the humus. * * *

Where clover was grown, crops rotated, live stock kept, and farm manure used, an equilibrium as to the nitrogen content of the soil was maintained, the mineral plant food was kept in the most available condition, and maximum yields were secured.

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[a] A progress record of experimental inquiries, published without assumption of responsibility by the Department for the correctness of the facts and conclusions reported by the stations.

[b] Compiled from Minnesota Sta. Bul. 94.

[c] U. S. Dept. Agr., Farmers' Bul. 87, p. 9.

VALUE OF MANURE AS AFFECTED BY FEED.[a]

In a recent bulletin of the Maine Station J. M. Bartlett reports results of studies of the relation between fertilizing constituents in feed consumed and manure (solid and liquid) excreted by steers during digestion experiments with hay, wheat bran, and cotton-seed meal. The fertilizing constituents in the feeds used were as follows:

Fertilizing constituents of feeds used.

Feed.	Nitrogen.	Phosphoric acid.	Potash.
	Per cent.	*Per cent.*	*Per cent.*
Hay	0.79	0.33	1.49
Spring-wheat bran	2.66	3.19	1.79
Winter-wheat bran	2.58	2.86	1.46
Cotton-seed meal	7.48	3.10	1.94

The value of the manure produced by 100 pounds of each of these feeds was as follows:

Value of manure produced by 100 pounds of each of the feeds.

Feed used (100 pounds each).	Value of manure produced.			
	Nitrogen.	Phosphoric acid.	Potash.	Total value.
Hay	$0.14	$0.01	$0.07	$0.22
Spring-wheat bran	.38	.12	.09	.59
Winter-wheat bran	.32	.09	.07	.48
Cotton-seed meal	.99	.09	.10	1.18

These figures show that in the purchase of feeds it is important not only to take into account their flesh-forming value, but also their effect upon the value of the manure produced. Feeds like cotton-seed meal, which are rich in nitrogen, phosphoric acid, and potash, produce manure rich in these elements, while feeds poor in fertilizing constituents, like hay, produce poor manure. If the manure is carefully saved and used it may therefore often be more economical to buy the high-priced feeds rich in fertilizing constituents because of the more valuable manure obtained.

Another important fact emphasized in these experiments is that a large part of the nitrogen, the most expensive fertilizing element, as well as of the potash, is found in the urine. Not only are the fertilizing constituents found in large quantity in the liquid portion of

[a] Compiled from Maine Sta. Bul. 126.

the manure, but they are in more available form here than in the solid excreta. The liquid portion is therefore the most valuable part of the manure and should be carefully saved.[a]

CONTINUOUS CORN CULTURE.[b]

In previous bulletins of this series[c] attention has been called to experiments at the Rhode Island Station tending to show the advantages of rotations in improving land of low fertility. As a further contribution to this subject, G. E. Adams and H. J. Wheeler, in a recent bulletin of that station, give an account of the results of twelve years' continuous culture of corn on the same land without the use of farm manures, but with the use of complete commercial fertilizers and cover crops (rye and crimson clover).

The total yield per acre for the twelve years was 440.1 bushels hard shelled corn, 67.5 bushels soft shelled corn, 18.7 tons stover, or an average of 36.67 bushels hard shelled corn, 5.62 bushels soft shelled corn, and 1.55 tons stover, which is above the average yield of corn per acre for the State as given by the census and statistical reports.

The cost of the manures used during the twelve years was $168.02 per acre, the cost of seed for the corn and cover crops $9.91, and the value of the total crop $368.40, thus leaving a balance of $190.47 for the period, or a balance of $15.87 per annum with which to pay the interest on investment, taxes, and cost of labor. At ordinary prices it is very doubtful if growing corn continuously could be considered a wise or profitable investment.

> When all of the items of expense are taken into account, and the fact that, where only one crop is grown for a long period of years upon the same land, the fertility is exhausted in a one-sided manner, the wisdom of growing crops in rotation which will feed upon the different plant foods of the soil in varying amounts becomes evidently the wiser course to pursue. Where a given crop is produced continuously, the cost of labor for tillage is often greater than where the same crop is grown in rotation.
>
> The fungus and insect pests are more difficult of control under a continuous system; therefore our motto should be rotation, and not continuous cropping.

The experiments show a decided advantage from using crimson clover as a cover crop for the soil during winter over rye for the same purpose. Thus the average gain for twelve years from using clover as a cover crop, after deducting the cost of the seed, was $50.24, or an average of $4.19 per acre annually; from using rye, $4.28, or an average of 36 cents per acre annually.

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[a] For a fuller discussion of this subject see U. S. Dept. Agr., Farmers' Bul. 192.

[b] Compiled from Rhode Island Sta. Bul. 113.

[c] U. S. Dept. Agr., Farmers' Bul. 144, p. 8.

PASTURING WHEAT.[a]

The pasturing of wheat is an old practise about which opinions of practical men differ widely. The subject has been studied during several seasons by the Oklahoma Station in the following way with the results stated:

A suitable location was selected in a farmer's wheat field where pasturing the wheat is followed, and nine half-acre plats were laid out and separated from each other and the field by 3-foot alleys in which the wheat was hoed out. Six of these plats were fenced separately and provided with gates, so that the stock might be allowed to run into any certain plat or kept off. Three plats were not fenced, which allowed the stock to pasture on them just as they pastured the general field. * * * The following treatments were given: The gates on two of the plats were left open all the time during the fall and winter and the stock allowed to run on these plats whenever they were in the field, but the gates were closed March 1 and no stock allowed on these plats after this date. * * * Two other plats were handled the same as the above two plats up to March 1, but from this time on the treatment differed. After the stock were taken off these two plats were not pastured until April 14, on which date 8 cattle and 3 calves were turned on the two plats and kept there for three days except at night. * * * On the other two plats that were fenced the gates were kept closed all the time and no stock allowed on the plats. * * *

Horses and cattle were turned into the field in which these plats were situated on October 24, at which time the wheat furnished considerable feed. Up to about the middle of January the pasturing was very fair. About this time the weather turned cold and snow fell, and during the greater part of February the weather was very cold and the ground covered with snow almost all of the time. During the greater part of these two months little wheat pasturing was available and the amount given the field for the season was lighter than usual. The latter part of February the weather moderated and the snow went off and by March 1 the wheat was making a nice start to grow. On this date, March 1, the gates on the "fall and winter" pastured plats were closed and no stock allowed on the plats again. At this time the ground was a little soft on top but not in a condition to allow the stock to damage the wheat materially by tramping. At this time there was some difference in the appearance of the pastured and the not pastured plats, the former being covered with considerable more growth. Heavy rains fell March 11 and showers on the 18th. On April 13 but little difference could be seen in the growth on the "fall and winter pastured" plats and the "not pastured" plats and the wheat in the field. In all these cases the growth was very good. It is well to bear in mind here that the pasturing given the field was lighter than usual and at no time was the wheat damaged by tramping, and, aside from the rust that attacked the wheat, the conditions for growth were very favorable thruout the season. * * * From the three years' trials the indications are that where wheat is judiciously pastured in the fall and winter and the stock removed in the spring by March 1, the yield of grain will be little if any reduced by pasturing and in some cases it seemed to increase the yield of grain. The results of the three years show without variation that the yield of grain is greatly reduced, usually about one half, by late spring pasturing of wheat.

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[a] Compiled from Oklahoma Sta. Rpt. 1906, p. 29.

STORAGE OF SWEET POTATOES.[a]

Sweet potatoes are perhaps the most difficult of all our common root crops to store successfully over winter. Unless free from disease and kept free from moisture, practically the entire crop is likely to rot even before midwinter.

The rots are caused by well-known plant diseases, one of the most injurious of which is the soft rot. This disease usually gains entrance to the potato thru some external injury, such as a bruise, broken skin, hoe or fork cut, and the like. No potatoes thus injured in the least should ever be stored, but should be marketed at once or used for stock. Any rotten tubers which are found in the storage bins during the winter should be removed and burnt.

Another disease which causes large losses in storage is the black rot. This disease attacks both the growing sets and the stored potatoes. The potatoes may look all right at the time of storage but still contain the organism of the disease. The practical measures which should be employed to treat the disease and prevent this rot in storage are thus given by E. M. Wilcox, in a recent bulletin of the Alabama Station:

(1) Never employ diseased roots to secure sets. (2) Destroy, by burning, all diseased roots and sets, and do not feed the diseased roots to animals if the resulting manure is to be placed upon the field where the potatoes are to be grown. (3) In general, commercial fertilizers are preferable in sweet-potato culture on the above account, and particularly in the beds employed for the growing of the sets. (4) As you select your sets it may be well to lift the root and discard sets coming from roots showing the rot. (5) Do not place diseased potatoes in storage, as the loss may be very great. (6) The young sets, if diseased, may be sprayed with Bordeaux mixture. (7) If the disease has proven serious during the past year it would be well to mix a tablespoonful of sulfur with the soil about each set as it is planted. (8) Practise rotation of fields if one field becomes too badly infected with the fungus. (9) Collect and burn all diseased roots and stems.

In order to lessen or prevent rot the potatoes should be perfectly dry when put in storage and kept dry thruout the period of storage.

During the sweating period just after the roots are stored care should be taken to see that proper ventilation is provided and that the temperature be kept at about 70° F. The temperature, in case enough roots are stored to make the erection of a regular storage house profitable, may best be secured by means of a small stove. Where the roots are stored in the usual dirt-covered piles it is important not to let water get on them whenever they are opened to remove any potatoes. The fungus requires a certain amount of moisture for its most rapid development, and this is too often furnished by carelessness in opening these piles.

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[a] Compiled from Ala. Sta. Bul. 135; Okla. Sta. Rpt. 1905–6. See also U. S. Dept. Agr. Farmers' Bul. 129, on sweet potatoes.

The Oklahoma Station recommends first kiln-drying the potatoes by keeping the temperature of the storage room up to 90° F. the first week, giving plenty of ventilation to carry off the moisture. After this the temperature of the storage room may be maintained at from 50 to 65° F.

If this process is not convenient a good method is to give all the ventilation possible, so the potatoes can dry very rapidly for about two weeks. It is necessary to guard the ventilation and permit only dry air to enter, as moist air will deposit its moisture on the cool potatoes and this will produce the best condition for the potatoes to begin rotting.

The storage room must be dry, and very few cellars meet this requirement. The ventilation should be just sufficient to keep the air pure and the potatoes dry. The condition of temperature should be provided for in the construction and location of the building. Small quantities of potatoes can be kept by storing them in dry sand or road dust and keeping them at the proper temperature. The old-time practise of piling the potatoes on the ground and covering them with straw and litter and then with soil is too often a failure to be recommended.

ROTTING OF POTATOES IN STORAGE.[a]

The rotting of potatoes in storage is often a source of serious loss. The Vermont and Maine stations have reported the results of experiments undertaken to determine the way in which the rot fungus is transmitted and the best methods of checking the trouble. C. D. Woods, of the Maine Station, reaches the conclusion that "the infection of the potatoes with the fungus occurs chiefly, if not entirely, in the field before digging. The infection is usually the result of diseased vines. The disease is transmitted, in the majority of cases, not directly thru the vine, but indirectly thru the soil. Potatoes may be infected directly in the field from spores introduced in the manure, or from rotten potatoes spread upon or left in the land the preceding year." It appears, moreover, "that abnormal conditions of moisture or temperature may cause abnormal activity in the fungus, and hence the rotting of the tubers." For this reason "there is far less liability of loss from rotting in the cellar in the case of late dug potatoes."

L. R. Jones and W. J. Morse, of the Vermont Station, have, however, obtained contradictory results in experiments on the latter point, but they recommend late digging to reduce rot in storage except on heavy wet soils in a wet season. They found no benefit from liming the potatoes or treatment with formaldehyde before storage. Drying the potatoes as much as possible before storage reduced rot materially. Cold storage at 40° F. was particularly

[a] Compiled from Maine Sta. Bul. 112; Vermont Sta. Bul. 119; Rpt. 1905, p. 279.

efficient in checking rot. With potatoes at 80 to 90 cents per bushel, as they were in the Burlington market in 1905, there was a wide margin of profit from cold storage.

"While it may not prove practicable for the smaller growers to do this, it certainly behooves everyone to appreciate the importance of placing the crop in the coldest storage room available and as promptly as possible after digging, when much rot is anticipated."

HOG COTS.[a]

According to W. Dietrich, of the Illinois Station, properly located and constructed hog houses or shelter are essential to success in swine husbandry in all regions with a cold or variable climate. The best location for a hog house is one that is well drained and well lighted

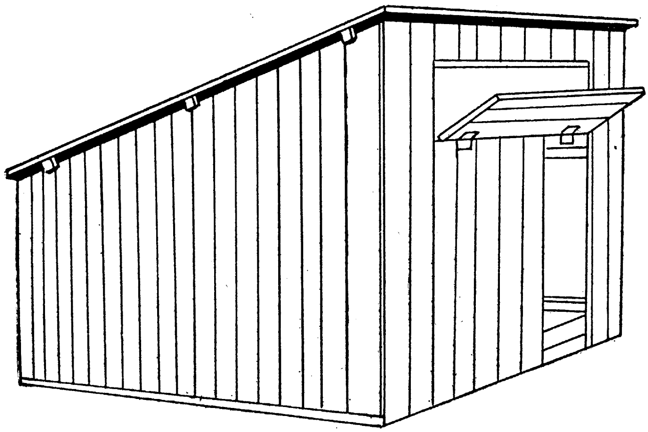

FIG. 1.—Hog cot with upright walls and shed roof, set up.

and will permit access to pasture, to good shade, and to a stream of running water that is free from disease germs, where also there are opportunities for making wallows in clean mud.

The two general classes of hog houses most in use are individual houses or hog cots and large houses with individual pens, and of each class there is a great variety of construction, depending upon individual needs and conditions. It is the purpose of this article to summarize only information regarding the construction of individual houses or hog cots as given in recent station publications.

Mr. Dietrich says on this subject:

Individual hog houses, or cots, as they are sometimes called, are built in many different ways. Some are built with four upright walls and a shed roof, each of which (the walls and roof), being a separate piece, can easily be taken down and replaced, making the moving of these small houses or cots an easy matter. This is shown by figures 1 and 2. Others are built with two sides sloping in

[a] Compiled from Illinois Sta. Bul. 109; Michigan Sta. Bul. 223; Rpt. 1905.

toward the top so as to form the roof, as in figure 3. These are built on skids, and when necessary can be moved as a whole by being drawn by a horse. They are built in several different styles; some have a window in the front end, above

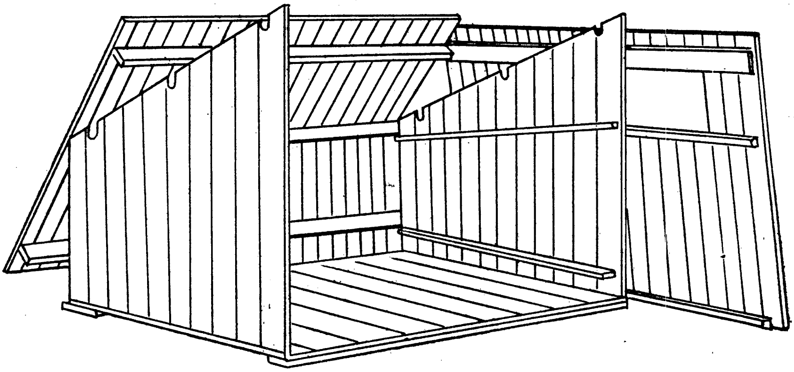

FIG. 2.—Hog cot with upright walls and shed roof, taken down.

the door, while all may have a small door in the rear end near the apex for ventilating purposes. They are also built in different sizes. Indeed, there are about as many forms of cots as there are individuals using them. The

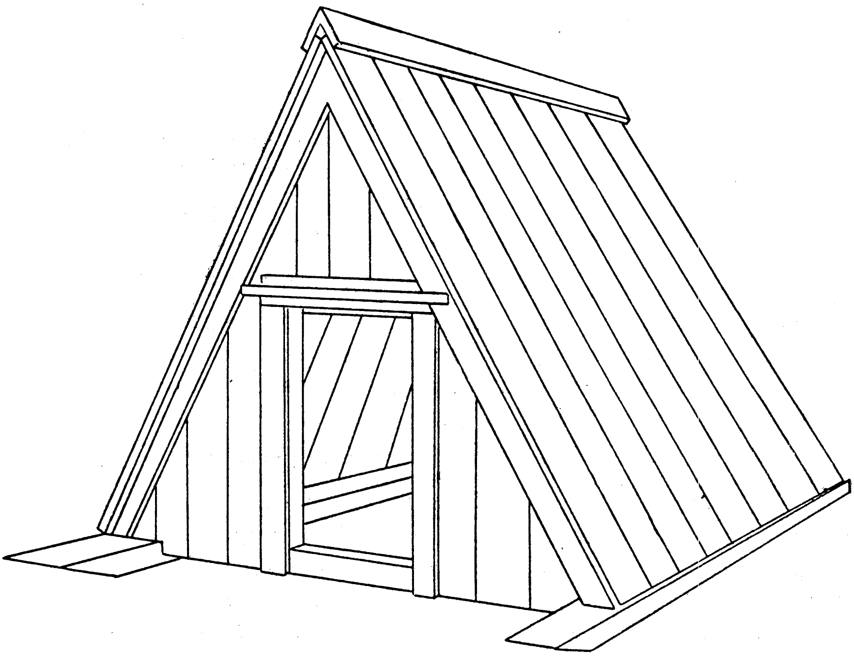

FIG. 3.—Hog cot with sloping sides, on skids.

form in which these houses or cots are built is of little significance as long as the general principles pertaining to the health of the animals and the convenience of the breeder are observed.

The arguments in favor of this type of houses for swine are that each sow at farrowing time may be kept alone and away from all disturbance; that each litter of pigs may be kept and fed by itself, consequently there will not be too large a number of pigs in a common lot; that these houses may be placed at the farther end of the feed lot, thus compelling the sow and pigs to take exercise, especially in winter, when they come to the feed trough at the front end of the lot; that the danger of spreading disease among the herd is at a minimum; and in case the place occupied by the cot becomes insanitary it may be moved to a clean location.

R. Shaw, of the Michigan Station, states that, when climatic conditions are not too rigorous, cots only may be employed for handling

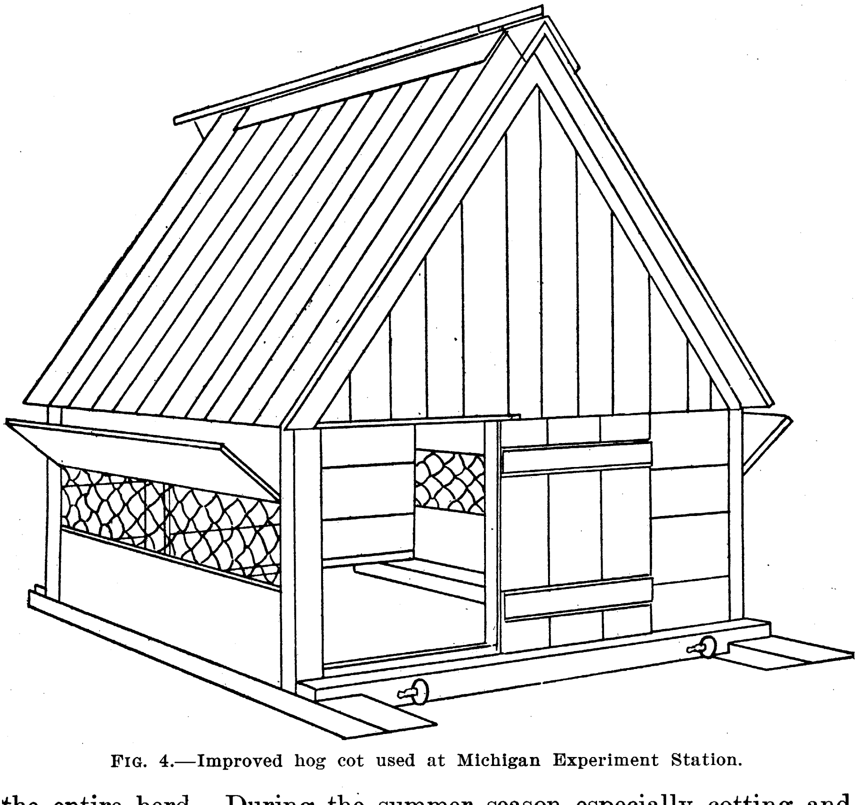

FIG. 4.—Improved hog cot used at Michigan Experiment Station.

the entire herd. During the summer season especially cotting and yarding can not be excelled as a means of handling nearly all classes of pigs. Cots are especially desirable for dry-brood sows and young males and females being reared for breeding purposes. Their great advantages are that they provide an abundance of fresh air, sunshine, and exercise.

Figures 3 and 4 represent forms of cots now in use at the Michigan Agricultural College, figure 3 being a form which has been in use at the institution for some years.

The form of cot shown by figure 3 is desirable in that it is warm in winter, but objectionable in that it provides little protection against the extreme heat of summer. It is also considered a good form of cot for the brood sow to farrow in in moderate weather, as she can not lie down close enough to the sloping roof to crush her pigs as against a wall. A general mistake is made in fastening this form of cot permanently to the skids or runners on which it is built. These are the first to decay and along with them the lower ends of the boards, thus making repairs impossible, even tho the balance of the structure remains sound. A separate pair of skids should be constructed for this or any other form of cot, so that they can be replaced. Its own weight will hold the cot in place on the skids while being moved. * * * All cots should be furnished with skids, so that they can be moved frequently by a team and one man and not taken to pieces and moved in sections.

Figure 4 represents a form of cot recently designed and constructed and now in use in our hog lots. It is 6 by 8 feet at the foundation, with the sides raised perpendicularly 3 feet before receiving the half pitch roof boards. The center boards on the sides are hinged so that they can be swung open in hot weather. The opening thus made is covered with strong woven wire, clamped above and below between inch boards. The inner clamp boards project an inch beyond the outer ones, thus breaking the joints and preventing any draft when the openings are closed. The two ridge boards are also hinged so that they can be opened during hot weather. These openings permit a free circulation of air, which not only lowers the temperature but greatly relieves the oppression of the pigs seeking shelter. These openings close down tightly, leaving warm quarters during the coldest weather. The cots proper are supported on skids to which they are not attached, being held in place by the blocking of the ties across both ends. A 2-inch bottom is used or not, as desired. This flooring is cut in lengths to fit crosswise and rest on the skids, which are wider than the sills. This form of cot is not desirable for the farrowing sow without the addition of a railing around the perpendicular walls a few inches from the floor to prevent her from overlaying her pigs. Probably the chief objections to this structure are the expense of material and cost of construction. It contains 160 feet stock lumber, 60 feet matched, 20 feet 4 by 6, 12 feet 4 by 4, and 44 feet 2 by 4, and requires two days' labor in construction.

THE DISINFECTION OF STABLES.[a]

The great importance of thoro disinfection of stables to prevent spread of disease, especially in case of such deadly diseases as tuberculosis, glanders, and many others, and the general lack of exact knowledge as to how such disinfection can be accomplished has led C. M. Haring, of the California Experiment Station, to compile the following simple directions for securing disinfection and sanitary conditions in stables:

Permit the entrance of a plentiful amount of light.—The bacteria of tuberculosis and most other disease-producing germs are destroyed by the direct rays of the sun within a short time. They are destroyed by less intense light more slowly, and will live for long periods in dark places. There are numerous other advantages in having plenty of light in a stable that are not necessary to mention here.

[a] Compiled from California Sta. Circ. 19.

Clean the stable thoroly.—Cleanliness is an important adjunct to the work of disinfection. The cleaning of the stable includes: (*a*) Removal of manure; (*b*) removal of piles of fodder; (*c*) removal of rotten woodwork and loose boards, especially the floor; (*d*) sprinkling with a disinfectant, to lay the dust, and sweeping of the ceilings, walls, and floor; (*e*) removal of dried accumulations about mangers, floors, and drains. The practise of washing the floors and ceilings with water before applying the disinfectant has, in most instances, the disadvantage that the water carries the micro-organisms to be destroyed into cracks, where they will not be affected by the later application of the disinfecting solution.

Apply chemical disinfectants.—After the stable has been treated as recommended above, it is ready for the application of chemical disinfectants. These are substances which poison the germs. There are many of them. Some are far more efficient than others. Among the most active are carbolic acid and corrosive sublimate.

Carbolic acid, when pure, is crystalline. It readily assumes the liquid state in the presence of a little water. As usually dispensed it consists of 95 parts of pure acid and 5 parts of water. For use as a stable disinfectant this should be mixt with water in the proportion of one to twenty, or 1 pint of acid to 2½ gallons of water. The "crude carbolic acid, saturated solution" is much weaker than the above and should not be diluted with water.

Bichlorid of mercury, or corrosive sublimate, is a most active germicide, and has the advantage over carbolic acid for use in a dairy stable, in being odorless. This substance is poisonous and must be used with great care. Before it is applied it must be dissolved in water, in the proportion of one part to one thousand. One ounce of corrosive sublimate dissolved in 8 gallons of water makes a solution of the right strength. In making the solution the corrosive sublimate should be dissolved in 1 gallon of hot water and then mixt with enough cold water to make 8 gallons. It corrodes metal, hence the solution should be kept in a wooden tub or earthenware crock.

There are many other efficient disinfectants, but the two above described are cheap and obtainable at any drug store. In the employment of commercial disinfectants it is necessary also to know the destructive value of the solutions for the organisms to be destroyed. There are many so-called disinfectants that, in the strength of the solutions recommended, are inefficient.

Disinfectants can not destroy germs with which they do not come in contact. The disinfectant should be applied in sufficient quantity to thoroly saturate the surfaces, including the adhering particles of dirt. In the application of the disinfectant it is well to use a broom and thoroly scrub the floor and lower parts of the walls. The solution can be applied to the ceilings and upper parts of the side walls with a spray pump, and must be carried into every crevice and recess into which dirt can enter.

After disinfecting, whitewash the stable. Altho whitewash is not an active disinfectant, in the usual meaning of the term, it is an excellent purifier and should in all cases be used in stables after they have been thoroly cleansed and disinfected with other agents. If chlorid of lime is added to whitewash in the proportion of 1 pound to 3 gallons, the value of this application is greatly increased. It is advisable to whitewash cow stables frequently, at least once in six months, and better every three months. Hot whitewash for this purpose is better than cold.

In discussing the importance of disinfection of stables and the danger of neglecting it, Doctor Haring points out that "negligence in

properly disinfecting stalls and stables where animals affected with contagious diseases have been is frequently the cause of a reappearance of the disease." The germs of glanders, for example, may remain alive in stables for several months after the diseased animals have been removed, and if thoro disinfection is not resorted to all animals housed in the stable are subject to infection from this source. "Many failures to eradicate tuberculosis from dairy herds by the repeated application of the tuberculin test and the prompt removal of all reacting animals are due to the fact that the stables were not disinfected." Tuberculosis spreads rapidly among cattle closely herded together. To prevent this, stables should be thoroly disinfected at least once a year.

THE EFFECT OF HORSETAIL WEEDS ON HORSES.[a]

The work of the Vermont Experiment Station in feeding horses the common horsetail weed has previously been referred to.[b] On account of the quite general prevalence of horsetail in native meadows in certain parts of Nebraska, the station in that State tested the effect of feeding this weed to horses. Complaints have been made of the death of horses which had eaten hay containing horsetail, and this seemed to be a good opportunity to test the matter.

Two horses were selected and were fed increasing quantities of dried horsetail, beginning with one-half pound per day and increasing to 2 pounds during the first two weeks, and finally to 6 pounds. This amount was fed until the animals refused to eat the material at all. One of the horses showed a dislike to the weed after four days and the other after twelve days. There appeared, therefore, to be no tendency to develop a depraved appetite for this material.

The symptoms of poisoning appeared first on the fourteenth day and reappeared at intervals until the experiment was concluded. The chief symptoms consisted in a loss of muscular control and lameness, together with a body temperature somewhat lower than normal and a bluish appearance of the mucous membranes. One of the animals used in the experiment ate 205 pounds of dried horsetail, and while the station does not consider the matter as absolutely settled, it appears that at present the common horsetail weed does not occur in large enough quantities in the hay of Nebraska to be dangerous to horses. If an animal could be induced to eat the material indefinitely, however, it is believed that fatal effects might be produced.

[a] Compiled from Nebraska Sta. Rpt. 1905, pp. 111–115.

[b] U. S. Dept. Agr., Farmers' Bul. 162, p. 22.

A NEW METHOD OF TREATING CALF SCOURS.[a]

As pointed out by L. A. Klein, of the South Carolina Station, one of the most common difficulties met with in raising calves on skim milk is the persistent form of diarrhea commonly known as calf scours. This disease is due to the action of various fermentative and putrefactive bacteria in milk. As is generally known, the undue growth of bacteria in milk may be largely prevented by the exercise of strict precautions from the time the milk is drawn from the cow until it is fed to the calf. The necessary precautions, however, involve more attention and labor than can always be expected from the average dairyman. The inevitable result of carelessness in handling milk is the development of large numbers of bacteria in it, and this in turn leads to calf scours, which always causes an unthrifty condition in the calf and may often produce death.

Proceeding on the basis of the results of investigations by Von Behring, the Maryland Experiment Station, and the Bureau of Animal Industry of this Department on the influence of formalin on disease germs and on digestion when administered in small amounts in milk, Doctor Klein treated 12 milk-fed calves affected with scours by adding formalin to the milk in the proportion of 1 part to 4,000 parts of milk. This dilution may be readily obtained by pouring 0.5 ounce of formalin into 15.5 ounces of water. From this stock solution 1 teaspoonful is added to each pint or pound of milk to be fed to the affected calf.

From the experiments just outlined it appeared that the results are practically the same whether the formalin solution is placed in the milk just before feeding to the calf or immediately after the skim milk is received from the separator. Apparently, however, it was advisable to add the formalin to the milk immediately after separation. Of the 12 calves treated in this way 11 recovered without any further treatment, 7 of them on the second day, 3 on the third day, and 1 on the ninth day. If further experiments show that formalin causes no injury to calves, this method furnishes an effective and practical means of controlling calf scours.

PRESERVING EGGS.[b]

As R. W. Thatcher in a recent bulletin of the Washington Station says, "the desirability of some simple, cheap, and satisfactory method for preserving eggs is apparent to everyone. A method of this sort

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[a] Compiled from Maryland Sta. Bul. 86; South Carolina Sta. Bul. 122; U. S. Dept. Agr., Bureau of Animal Industry Rpt. 1903, p. 114.

[b] Compiled from Washington Sta. Bul. 71.

which would enable farmers, poultrymen, and consumers to put away eggs in the summer, when they are plentiful and comparatively cheap, and preserve them until the winter season, when they are scarce and high in price, would be of very great value." A large number of methods have been suggested, but only two or three have proved practical or satisfactory for general use.[a] Of these the water-glass method, using 5 and 10 per cent solutions, and limewater-salt-brine mixture method (1 pound of quicklime, half pound of salt, and 1 gallon of boiled water) were tested by Professor Thatcher. He found that eggs can be kept in good condition for home use for at least eight months by immersing them in a water-glass solution or in limewater and salt brine, altho those preserved in water glass appeared to come out in better condition than those kept in the lime-and-salt mixture.

Other experimenters have succeeded in keeping eggs to their entire satisfaction in solutions of water glass as dilute as 5 per cent, but the author's experience was that a stronger solution gave a better preservation. It seems probable that a solution halfway between the two which were used, in strength, would be better than either of these, since it would doubtless give a better product than the weaker solution and would not deposit sediment, thereby gradually losing strength, as the stronger solution did.

The cost of preserving eggs in a water-glass solution of the strength just described, exclusive of the cost of the containers, would be less than 1 cent per dozen. Water glass can be obtained of any wholesale drug firm at a cost of about 10 cents per pound, and a pound of it properly diluted should be sufficient to cover 12 or 15 dozen eggs, the exact amount required depending upon the size and shape of the container.

Any vessel which will hold water and which can be covered tightly enough to prevent evaporation will do as a container for eggs put up in this way. Stone jars are preferable, as they are very easily cleaned and prevent evaporation almost perfectly. Wooden kegs can be used, but in case this is done care must be observed to see that the solution does not become too strong on account of the water absorbed from the solution by the keg.

The following directions for packing eggs in water glass are given:

Use only perfectly fresh eggs. Stale eggs will not keep by any method of preservation. Clean out the vessel in which the eggs are to be packed (preferably a stone jar) by scalding with boiling water. Prepare the solution, using water that has been first boiled and then cooled to ordinary temperature.

To each 15 quarts of water add 1 quart of water glass. Pack the eggs into the jar and pour the liquid over them, covering the eggs completely. Do not wash the eggs before packing them, as this may injure their keeping qualities by removing a natural protective coating on the outside of the shells.

Keep the eggs packed in this manner in a cool, dark place, such as a dry, cool cellar.

Each day's gathering of eggs may be packed immediately after gathering by placing them in the jar and pouring over them just enough of the solution to cover them. This is better than to hold the eggs for several days at the risk

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[a] See also U. S. Dept. Agr., Farmers' Buls. 103, p. 17; 128, p. 27.

of their becoming stale in order to have a sufficient number to fill the entire vessel at one time. In some of the warmer sections of the State, during the summer months, the temperature often rises high enough to start incubation in eggs. In such localities eggs must be packed soon after they are laid or kept in some cool place until they are to be packed.

Water glass is a somewhat alkaline liquid, but the diluted solution is not injurious to the hands if they are dipt into it in packing successive gatherings of eggs, or in removing the eggs from the solution.

It is stated that eggs packed by this method will keep for some time (as long as 4 weeks) after they have been taken out of the preservative solution.

WHEAT BRAN.[a]

A prominent feature of modern industrial development is the increasing attention which is being given to the utilization of by-products of various kinds. Many such by-products which were formerly mere waste are now used to good advantage, and in many cases represent a very large proportion of the profits of the industry which produces them. Notable examples of this are: Cotton-seed and linseed meals, by-products of oil manufacture; gluten feeds, by-products of starch manufacture; milling by-products, and many others which are of great importance from an agricultural standpoint as feeds, fertilizers, etc. One of the best known of these by-products and one which has long been recognized as a valuable feeding stuff is wheat bran. Of this material J. B. Lindsey, of the Massachusetts Experiment Station, says:

Until within comparatively recent times, wheat bran and corn meal have formed the two staple concentrated feeds for dairy stock, and in spite of the large variety of concentrates now in the market, the former still continues to be used largely by the great majority of dairymen in our Eastern States. The reasons for this are not difficult to find. A good quality of bran is uniformly palatable; it can be fed in considerable quantities without producing any ill effects; it acts as a slight laxative; it furnishes more digestible protein than corn, and it serves as a very satisfactory diluter or distributer of the heavy concentrates, such as the glutens, cotton-seed meal, and flour middlings,.

Lindsey believes, however, that the nutritive material contained in bran can be purchased more cheaply in other concentrated feeds and that New England farmers especially often use more of it than economy warrants. In support of this belief, he compares the composition, digestibility, cost of digestible nutrients, and value of fertilizing constituents of bran and other concentrated feeds, such as cotton-seed meal, gluten feed, dried distillers' grains, dried brewers' grains, malt

[a] Compiled from Massachusetts Sta. Rpt. 1905, p. 94.

sprouts, etc., all of which are by-products like bran. The results show that all of the other feeding stuffs named contain more total and digestible protein, upon which the nutritive value of a feeding stuff so largely depends, than wheat bran.

Wheat bran contains noticeably less total as well as less digestible protein than any of the other nitrogenous by-products. The total digestible matter in bran is likewise less than in the other prominent concentrates; thus, cotton-seed meal contains 24 per cent more, gluten feed 44 per cent, distillers' grains 21 per cent, and corn meal 38 per cent.

For several years past the cost of a pound of digestible matter in bran, cotton-seed meal, and distillers' and brewers' dried grains has been about the same; it could be purchased in the form of gluten feed, corn and hominy meals, for some 20 per cent less. A pound of digestible protein in wheat bran cost 100 per cent more than in cotton-seed meal, 80 per cent more than in gluten feed, and 50 per cent more than in distillers' dried grains.

Because of its relatively low protein percentage, the fertilizer ingredients in bran have from 10 to 50 per cent less money value than those contained in the other by-products.

The nutritive material and especially the protein contained in wheat bran must be regarded, therefore, as relatively expensive. Because of its palatability, its laxative effect, and its desirability as a diluter or distributer of the heavy concentrates, it will continue to be used by many farmers as a portion of the grain ration for dairy stock.

As a practical deduction from these facts and from the results of experiments to find cheaper rations for milch cows than those containing large amounts of bran, Lindsey suggests that—

Farmers who keep comparatively small herds, and who personally look after the feeding, may reduce the quantity of purchased grain to 3 or 4 pounds daily per head and substitute home-grown corn in place of wheat bran. Five to 7 pounds of grain daily is the usual allowance for cows producing about 10 quarts of milk of average quality. This grain mixture may consist of 1½ pounds of cotton-seed meal, 2 pounds of flour middlings, and 2½ to 3 pounds of corn or corn-and-cob meal daily; or 1½ pounds of cotton-seed meal, 2 pounds of oat middlings or rye feed, and 2½ to 3 pounds of corn meal. Malt sprouts may be substituted for the wheat, oat, or rye middlings. The several grains, after being mixt, should be distributed thru the silage or cut hay with the aid of a fork. This method of feeding will enable the farmer to get along with a minimum cash outlay for grain (4½ cents daily), and at the same time he will be supplying a well-balanced ration, rich in elements of fertility. The method will be more particularly suited to farmers not having easy transportation facilities and who sell their dairy products to the creamery.

Farmers and dairymen who can not closely supervise the feeding and who desire to feed more than 5 to 7 pounds of grain daily will probably find it advisable to use one-third to one-half wheat bran in compounding the grain mixture. Distillers' grains and malt sprouts have also been shown to be quite satisfactory distributers of the heavy concentrates.

TESTING INDIVIDUAL COWS.[a]

Many tests at the experiment stations and elsewhere have shown that some cows in nearly every dairy herd are kept at a loss.[b] They consume feed worth much more than the milk and butter they produce. This well-known fact has again and again been brought to the attention of dairymen in a variety of ways, and it would almost seem that every owner of a dairy herd at the present time would take the small amount of trouble required to ascertain the productive capacity of each cow in his herd and then at least to dispose of those that are clearly unprofitable. But such is not the case.

In a recent circular of the Illinois Station, H. A. Hopper reports the results of tests of 221 cows representing 18 herds kept under a wide range of conditions in the southern part of the State. The work was undertaken for the express purpose of demonstrating to dairymen in that locality the inferior condition of many of their herds, and thereby inaugurating a movement toward securing better dairy stock. The results obtained are very instructive. The following table shows the yearly record of the best and the poorest cow in each herd as well as the average for the entire herd:

Tests of cows in 18 herds in Illinois.

Herd and cow.	Yield of milk.	Fat content of milk.	Yield of butter fat.	Returns from milk at $1.15 per 100 pounds.	Returns from butter fat at 25 cents per pound.
Herd 1 (11 cows):	*Pounds.*	*Per cent.*	*Pounds.*		
Best cow	6,099.3	5.17	315.38	$70.14	$78.84
Poorest cow	4,391.3	3.91	171.67	50.49	42.91
Average cow	5,753.1	4.54	261.61	66.16	65.40
Herd 2 (8 cows):					
Best cow	8,738.7	3.81	333.35	100.50	83.34
Poorest cow	4.928,4	3.92	193.29	55.68	48.32
Average cow	7,376.4	3.19	267.75	84.82	66.93
Herd 3 (5 cows):					
Best cow	9,454.3	3.40	324.08	108.72	81.02
Poorest cow	6,719.1	3.27	221.13	77.26	55.28
Average cow	8,056.8	3.42	275.78	92.65	68.94
Herd 4 (11 cows):					
Best cow	7,445.1	4.82	358.59	85.62	89.65
Poorest cow	4,091.2	3.83	156.71	47.05	39.18
Average cow	6,219.8	3.89	242.32	71.52	60.58
Herd 6 (20 cows):					
Best cow	9,067.0	4.41	399.47	104.27	99.57
Poorest cow	5,796.4	3.65	211.80	66.65	52.95
Average cow	7,873.2	3.62	285.21	90.54	71.30
Herd 7 (10 cows):					
Best cow	5,506.8	4.70	264.01	63.34	71.30
Poorest cow	3,412.1	3.78	128.96	39.24	32.24
Average cow	4,524.8	3.76	170.49	52.03	42.62
Herd 8 (10 cows):					
Best cow	6,647.0	3.09	263.42	76.20	65.38
Poorest cow	2,690.8	3.61	97.17	29.94	24.29
Average cow	4,485.7	4.29	192.51	51.58	48.12
Herd 10 (13 cows):					
Best cow	7,291.0	4.31	314.96	83.84	78.74
Poorest cow	3,846.7	4.38	168.48	44.23	42.12
Average cow	5,430.9	4.18	227.31	62.45	56.31

[a] Compiled from Illinois Sta. Circ. 102.
[b] See U. S. Dept. Agr., Farmers' Buls. 114, p. 21; 162, p. 24; 190, p. 14.

Tests of cows in 18 herds in Illinois—Continued.

Herd and cow.	Yield of milk.	Fat content of milk.	Yield of butter fat.	Returns from milk at $1.15 per 100 pounds.	Returns from butter fat at 25 cents per pound.
	Pounds.	*Per cent.*	*Pounds.*		
Herd 11 (9 cows):					
Best cow	6,531.0	3.78	246.70	75.10	61.67
Poorest cow	5,551.6	3.01	167.56	63.84	41.89
Average cow	5,969.4	3.43	205.02	68.64	51.25
Herd 12 (13 cows):					
Best cow	6,429.4	3.80	248.36	73.93	62.09
Poorest cow	2,090.4	4.83	101.05	24.03	25.26
Average cow	4,503.7	3.89	175.41	51.79	43.85
Herd 15 (12 cows):					
Best cow	6,289.0	4.74	298.57	72.32	74.64
Poorest cow	3,491.1	3.01	135.29	40.44	33.82
Average cow	5,127.8	4.03	206.78	58.96	51.69
Herd 16 (9 cows):					
Best cow	5,292.6	4.49	237.64	60.86	59.41
Poorest cow	3,751.5	3.99	150.01	43.14	37.50
Average cow	4,607.5	3.98	183.52	52.98	45.88
Herd 17 (7 cows):					
Best cow	6,114.5	3.31	202.70	70.31	50.67
Poorest cow	3,710.4	3.33	123.53	42.67	30.88
Average cow	4,354.7	3.96	172.64	50.08	43.16
Herd 19 (19 cows):					
Best cow	6,412.7	4.57	292.82	73.75	73.20
Poorest cow	4,529.8	3.49	158.07	52.09	39.51
Average cow	5,409.7	4.11	242.94	62.21	60.73
Herd 20 (15 cows):					
Best cow	7,529.5	3.93	296.09	86.59	74.02
Poorest cow	2,980.0	4.56	136.02	34.27	34.00
Average cow	6,106.3	3.84	235.04	70.22	58.76
Herd 21 (15 cows):					
Best cow	8,882.3	3.75	332.77	102.15	83.19
Poorest cow	4,025.1	3.55	143.12	46.29	35.78
Average cow	5,970.9	4.06	242.87	68.67	60.71
Herd 23 (25 cows):					
Best cow	4,337.2	4.96	215.55	49.87	53.88
Poorest cow	1,845.8	4.24	78.34	21.22	19.58
Average cow	3,314.1	4.28	142.05	38.11	35.51
Herd 24 (9 cows):					
Best cow	6,911.4	6.91	477.30	79.48	119.32
Poorest cow	3,477.6	4.64	161.46	39.99	40.36
Average cow	5,921.4	5.91	350.17	68.09	87.54

From the above data it is seen that the best herd (No. 24) produced 2,607.31 pounds of milk and 208.12 pounds of butter fat more per cow than the poorest herd (No. 23). An average herd (No. 10) produced 2,116.76 pounds of milk and 85.26 pounds of butter fat more per cow than the poorest herd. The best 10 cows produced on an average 388.75 pounds of butter and the poorest 10 cows 109.42 pounds. The average butter-fat production of the poorest herd (142.05 pounds) was 84.57 pounds less than that of the average of all the cows tested (226.62 pounds).

One of the most striking points brought out in this circular is the contrast between the production of the herds in which no attempt at improvement had been made and the herds in which some systematic effort in grading up by the purchase of dairy-bred cows or the use of pure-bred dairy sires had been put forth. The herds numbered 7, 8, 12, 15, 16, 17, and 23 in the above table were of the first class, and the average butter-fat production of the cows in these herds was only 177.62 pounds. The cows in the remaining herds produced on an average 263.09 pounds of butter fat. This makes a difference

of 85.47 pounds, which, at 25 cents per pound, amounts to $21.36, and this represents the profits from only one step in the right direction.

A consideration of the figures presented in this circular should convince the owner of any dairy herd of the wisdom of finding out by the scales and the Babcock test what his cows are producing and the profits of improving his herd by selection and breeding.

CLEAN MILK.[a]

This subject is attracting more and more attention from both consumer and producer. Not long ago an effort was made in an article in this series of bulletins[b] to point out some of the everyday forms of milk contamination to show to what extent milk may become impure by certain common dairy practises, and finally to summarize some of the best suggestions offered for the improvement of milk supplies. That article was based upon careful experiments and observations reported in bulletins of the experiment stations. Since then other station publications have appeared, which show even more clearly the importance of this subject and the need of diffusing accurate information concerning it. With this in view, some of the results of investigations by W. A. Stocking, jr., of the Connecticut Storrs Station, and by J. B. Lindsey and P. H. Smith, of the Massachusetts Station, are here briefly presented. As the conclusions reached by these investigators are based upon much experience they are freely quoted.

In a series of experiments Stocking studied the effect upon the purity and quality of milk as measured by bacterial content of certain common dairy practises, such as feeding and brushing cows, stripping, etc. He found that feeding hay, dry corn stover, and dry grain just before or at milking time greatly increased the bacterial contamination of the milk. Brushing the cows at milking time had also a similar effect, because the hair and dust thus set free into the atmosphere settled into the milk pail. Wiping the flanks and udder of the cow with a damp cloth just before milking was very effective in reducing the bacterial content. Thoro stripping reduced the number of bacteria found in the milk at the next milking, while leaving a small amount of milk in the udder had directly the opposite effect.

That the intelligence and personal habits of the individual milker are important factors in determining the germ content of the milk was shown by several experiments. Five students trained in dairy-

[a] Compiled from Connecticut Storrs Sta. Bul. 42, Rpt. 1905, p. 164; Massachusetts Sta. Bul. 110; U. S. Dept. Agr., Bureau of Animal Industry Bul. 87.

[b] U. S. Dept. Agr., Farmers' Bul. 227, p. 24.

ing were compared with two regular milkers. Altho stable conditions were identical and the same procedure was followed in all cases, the milk obtained by the students contained on an average 1,932 bacteria per cubic centimeter less than the milk obtained by the regular milkers. A still greater difference was observed when a college graduate and dairy expert was compared with the regular milkers. The difference in this comparison amounted to 14,650 bacteria per cubic centimeter. These differences were due to the greater care exercised by the trained men in their work.

Under ordinary methods of producing and handling large numbers of bacteria get into milk. It is highly desirable that dairymen should know how to prevent the entrance of these organisms into the milk and to so handle it that the growth of those which do get in will be reduced to the minimum. It is possible to produce a grade of milk which shall contain but very few bacteria. This is demonstrated by some of the so-called "sanitary" or "certified" milks which are now on the market, but these are produced at an increased cost and are sold at a price considerably above that of the regular market milk. The average consumer is unwilling to pay the increased price charged for this grade of milk, yet insists on being supplied with a good wholesome article. At the present price which the average producer gets for his milk he can not afford to greatly increase his cost of production. In order to meet the public demand for a better grade of milk, he must therefore make use of inexpensive means for preventing the entrance and controlling the growth of bacteria in his milk. The thing of first importance is to prevent bacteria from getting into the milk. This must be borne in mind at every step in the production and subsequent handling, but primarily while the milk is being drawn from the cow and until it is taken from the barn, for it is in the stable that milk usually gets its greatest bacterial contamination.

During the last two years Stocking has also investigated the sanitary condition of milk as produced and delivered by individual dairymen, making chemical and bacterial examinations of the milk delivered each day by thirty producers for shipment to the city in a certain locality in Connecticut.

When judged from the chemical standpoint alone, all of the milk examined was of excellent quality, but when the dirt contamination and the numbers of bacteria, with the consequent lessening of time of keeping, were taken into account much of the milk was considered very inferior in quality. In fact, most of it was so bad "that it was impossible to keep it sweet long enough to get to the city even when placed in cars and iced as soon as received." It was found necessary to pasteurize it before shipping and also to run it thru a separator in order to remove a portion of the insoluble filth. It is not probable that the condition here described is general or that it represents the average quality of Connecticut milk, but the facts recorded show that unclean and insanitary methods are still practised, to the great menace of health.

From a careful inspection of conditions on farms supplying milk to the towns of Amherst and Northampton, Mass., and chemical and bacteriological examination of the milk produced, J. B. Lindsey and P. H. Smith, of the Massachusetts Experiment Station, reach the conclusion that the ordinary method of housing and caring for dairy stock is far from ideal, altho capable of being considerably improved at a minimum outlay of time and expense. It was found that the majority of the stables were unnecessarily dirty, poorly lighted, and badly ventilated; the condition of many barnyards was bad, and the manure was improperly stored and cared for. In many cases the cows were poorly groomed, and some were disgracefully dirty. Altho the physical health of the dairy stock appeared reasonably satisfactory in most cases, it is not believed that animals kept in dark and poorly ventilated barns can be in the best physical condition to furnish a first-class human food.

As a general result of the examinations, the following improvements are urgently recommended: Cleaner barns, more light, fresher air, cleaner animals, and better sanitary methods of caring for the manure.

It remains for each individual producer of milk to ascertain how far his own conditions fall short of these simple fundamental requirements and to remedy them in the interest of cleanliness and sanitation, for, as Lindsey and Smith say, even "the producer of what might be termed common or ordinary country milk is under obligation to the public to produce a reasonably clean article."

Light, air, clean barns, clean cows, pure water, well-drained barnyards, clean milkers, clean milk vessels, and care in handling milk are essentials which the public has a right to expect. They do not require an outlay of capital sufficient to put them beyond the reach of the ordinary producer, and he who will conform to them will have done all that can be reasonably expected of him.

Milk is the principal food of infants and young children. It is largely used by invalids, and it forms one of the articles of food in every household. It is, of necessity, produced in such a way as to render it easily liable to contamination, and it is a most favorable medium for bacterial growth. It is not for the true interest of the dairyman to allow the consumer to gain the impression that this most desirable and universally used food is produced, cared for, and distributed in an unsanitary manner.

On the other hand, the general public needs to be educated to a better appreciation of the food and economic value of clean milk. On this point Lindsey and Smith say:

The consumer ought to be willing to pay a fair price for milk produced under reasonable sanitary conditions. Milk with 5 per cent fat is certainly worth more than that with 3 or 4 per cent, and clean milk ought to command a premium over that produced under dirty conditions. The average consumer has shut his eyes to these differences. To him milk has been rather of a

household necessity, to be bought as cheaply as possible. As to the methods and care used in its production, he has been lamentably ignorant. In all probability he has never once inspected the source of his daily supply. If his children become ill, he willingly employs physician and nurse, but he is likely to begrudge the dairyman a little advance in price that will encourage him to produce a safe and wholesome food product for his entire family. He pays dollars to overcome the illness, instead of dimes to remove the cause.

Since 1897 the cost of producing milk has noticeably increased. Thus the cost of grain has advanced 50 to nearly 100 per cent. Wages for farm labor have risen, and satisfactory help is difficult to obtain. During this time the average price of milk in the towns and smaller cities has remained nearly stationary, being 6 and, in exceptional instances, 7 cents a quart. Now, the consumer should not overlook the fact that it costs money to have clean barns, clean cows, clean dairy utensils, and neat and attractive surroundings. It means extra labor, and a better class of farm help than is ordinarily procurable.

The records of the [Massachusetts] station herd since 1895 have shown that the average food cost of a quart of 5 per cent milk has been 2.5 cents, while for the last two years the food cost of a quart of such milk has been 2.75 cents. To this should be added the cost of caring for the cows and milk, ice supply, delivery of milk, bad debts, and a fair profit. The writers are firmly of the opinion that, when reasonably satisfactory sanitary conditions prevail, milk testing 4.5 to 5 per cent of butter fat ought to bring 8 cents a quart at retail in order for the producer to secure a fair return on his investment. Strictly sanitary or certified milk will cost several cents in advance of this figure.

The consumer demands that other food necessities be produced and handled in a cleanly manner, and willingly pays a fair price for them. Why should he not do the same for clean milk?

The consumer can further aid the producer by placing the milk in a refrigerator or other cool place as soon as received. It should not be forgotten that milk absorbs odors easily and is rapidly contaminated by dust particles, hence milk kept in open vessels, pitchers, and pans should be covered to avoid such sources of trouble. It is hardly necessary to state that all vessels should be thoroly washed in boiling water and well aired before receiving the daily milk supply. Cooperate with the producer and the producer will cooperate with you.

What may be accomplished by cleanliness and cold in the production and handling of milk was well illustrated by the milk and cream exhibit at the National Dairy Show at Chicago. In drawing lessons from this contest, the primary object of which was to show that milk and cream produced under sanitary conditions can be shipped long distances and held for weeks without other means of preservation than cleanliness and cold, C. B. Lane says:

It may be said concerning the market milk exhibited that a large percentage of the samples remained sweet for a week in the exhibit case, the temperature of which was about 50° F. While these samples probably represented a very much higher quality of milk than that ordinarily supplied to our cities, it may be said to be demonstrated that market milk will keep for several days if handled with reasonable care and held at a temperature below 50° F.

CLEANLINESS IN THE DAIRY.[a]

O. Erf and C. W. Melick maintain in a bulletin of the Kansas Station that "cleanliness is the first law which should be observed by every man who in any way manufactures or handles dairy products," and show that this applies particularly to the utensils used in the dairy, for unclean dairy utensils are among the greatest sources of contamination of milk by undesirable bacteria, which produce taints in milk and which exist principally in filth lodged on the surface and in the crevices of dairy utensils. The real object of sanitation (washing and cleaning) is to get rid of these undesirable germs, for "while it is a fact that some of them are harmless, still there are many which are harmful to human life, hence we must establish conditions by which we can destroy them effectively and without great expense."

The first requisite is to purchase dairy utensils that can be easily cleaned, which have smooth, hard, and nonporous surfaces, and corners so made that they are easily accessible to a brush or cloth. Unnecessary corners and angles should be avoided.

Wooden utensils should never be used for receiving milk, as wood contains myriads of small pores which retain milk, making it impossible to clean such vessels thoroly.

Glass and earthenware have sometimes been used and are very efficient, but, on account of their expensiveness, the ease with which they are broken, and their great weight, they are impractical for dairy use.

Tinned metal complies most nearly with all requirements, and is the cheapest and most practical at the present time. However, the metal should be of good quality and heavily and smoothly tinned to avoid bare iron spots, which are liable to corrode and become rough, thus serving as breeding places for bacteria. It is not deemed wise to use galvanized iron, zinc, or other rough-surface metal.

All joints, corners, seams, and crevices should be made smooth and filled entirely with solder. Prest tin or seamless utensils are preferable from a sanitary standpoint. Milk pails in particular should have no corners, so that there will be no places for bacteria to grow. Strainers and aerators should be made likewise smooth and with as few projecting nuts, rods, or braces as possible. Storing or delivery cans, dippers, and other utensils must also comply with this rule. A new piece of strainer cloth should be used at each milking.

The principal things necessary for keeping utensils clean are hot water or steam, some alkali, a scrubbing brush or a coarse cloth, combined with plenty of elbow grease to make these agents effective. All utensils should be cleaned immediately after using. The method for cleaning varies slightly according to what the utensils have contained. If they have been used for milk, they should first be rinsed with cold or lukewarm water so as to wash off the viscous albuminoids, which if subjected to boiling water would coagulate and adhere firmly to the tin, thus becoming difficult to remove. They should then be thoroly washt in hot water with some cleansing material, such as washing powders or caustic soda, in order to remove the grease. The water should be

[a] Compiled from Kansas Sta. Buls. 131, 138.

quite hot and the washing powders should not be used sparingly, for we too often find vessels where the grease has not been removed, but simply smeared over the tin. Caustics and washing powders are not only effective in cleaning the grease from utensils, but they also act as a means of destroying bacteria. Common soaps, and especially if perfumed, should be avoided. After the washing, utensils should be treated differently according to conditions. If steam is at hand, a thoro steaming should follow, steam being the cheapest and most effective agent for destroying germs in creameries, cheese factories, and large dairies. Since the production of steam requires a boiler, which is quite expensive for the average dairy farmer, it is necessary in his case to pursue a different course for destroying bacteria.

It has been found that a 5 or 7 per cent solution of good fresh washing powder applied in hot water will make a good material for destroying germ life, provided the utensils are subjected to this solution for at least 10 minutes, after which they should be rinsed in hot water and set away in the pure air to dry. The latter method requires more time to accomplish the same purpose than with steam, but is better adapted for farm use.

There are other methods for conveniently destroying bacteria on dairy utensils; they are, however, more expensive, but very effective. A practical way is to rinse the utensils, after they have been thoroly washt in some alkali, with a hot solution containing 6 to 12 per cent borax. This solution also preserves the tin to a slight extent, but care must be taken not to get it into the milk.

Sunlight and pure air are the cheapest and most effective means of keeping the utensils pure and sanitary after they have been cleansed. Where these conditions do not exist, it is then advisable to put them in a hot drying room.

Old unclean dishcloths should never be used for wiping dairy utensils after they have been steamed or subjected to the hot washing solution, as the germs which are lodged in the cloth will be again distributed over the surface of the vessels, thus reinfecting them. If utensils must be wiped dry, it is always best to use a coarse linen cloth which has previously been steamed or boiled.

Scrub brushes are the best articles for use in cleaning dairy utensils. Coarse linen cloths may also be used, but they require more care in keeping them clean. The same methods for cleaning utensils should be followed for cleaning cloths.

Cleaning cream separators.—It is stated that "the hand cream separator is probably the most complicated piece of apparatus used in the dairy, and hence most likely to be the greatest source of contamination of milk." In view of this and the further fact that the use of cream separators on the farm is rapidly increasing, the Kansas Station undertook experiments to determine the extent of contamination which results from the several methods of treating the cream separators as advocated by separator agents and practised by farmers. In these experiments tests were made of the relative cleanliness of various methods of (1) flushing out the bowl with water and (2) thoroly washing cream separators.

The experiments were made with three separators of average size in common use in Kansas. The conclusions reached were as follows:

A cream separator should be thoroly washt every time after using. A brush should be used on every part and piece, using 5 per cent solution of borax or other good washing powder. Rinse in hot water, or steam if possible. They

should then be left to dry while hot. Wiping with an ordinary clean cloth contaminates utensils with innumerable bacteria.

The bacterial contamination in milk is increased from three to five times by running it thru a separator bowl which has been used and only flushed and left standing several hours. If only flushed while using for several days, the contamination increases several times more, and such milk would be likely to be detrimental if fed to calves.

The use of washing powder in flush water reduces the number of bacteria in the following batch of milk that is run thru, and cleanses the separator more than hot water alone, but not sufficiently to warrant that method of cleaning.

The use of a cream separator that is thoroly washt reduces the number of bacteria in milk one-fifth to one-fourth.

Improper cleaning is detrimental to a separator on account of the rust that accumulates on dirty or damp places. This may shorten the life of the machine many months, depending on the degree of cleanliness employed.

Running milk thru a dirty separator is similar to running it thru a dirty strainer, with all of the filth of the previous milking left in it from twelve to twenty-four hours. The millions of undesirable bacteria from the dirt, manure, and slime lodged in the separator bowl spoil all the milk, to a greater or lesser degree, that passes thru the machine.

When properly used, a cream separator is a clarifier and to a certain extent a purifier of milk, but when carelessly used it is a source of filth and contamination.

Clean wash water for butter.—In view of the fact that "one of the greatest sources of contamination in creamery butter is that of impure wash water," further experiments were made at the Kansas Station to determine definitely the amount of contamination due to the use of various kinds of wash water (from hydrant, melted ice, etc.) treated in different ways, namely, pasteurized, filtered, etc.

The results show that there was a direct relation between the bacterial content of the wash water used and the keeping quality of the butter produced. "Cream may be well pasteurized, and the best of starter may be added so as to produce a perfect flavor, and the entire product may be spoiled by washing it with the average creamery water."

While the keeping of water at 40 to 50° F. for a few hours prevents the growth of bacteria and destroys from one-half to four-fifths of those present, "water melted from ice, even tho kept at 50° F., may become filled with bacterial growth if allowed to stand for a few hours in a wooden tank from day to day without thoro cleaning. Great care should therefore be taken in the utilization of such water for cooling purposes."

A filter for creamery water is considered only a source of contamination and filth unless frequently cleaned and refilled with fresh filtering material

The results, however, indicate that it is both practical and economical to sterilize wash water for butter if it can be cooled and used immediately. Otherwise the practise is a useless expense.

Figuring the cost of fuel for production of steam necessary to sterilize wash water for 1,000 pounds of butter in the average creamery at 15 cents per day, ice for cooling it at 25 cents per day, and extra labor in handling it at 10 cents per day, amounts to 50 cents. Where 1,000 pounds of butter per day are made, which sells for 1 cent more per pound on account of the use of sterile water, it amounts to $10. Deducting 50 cents for labor, steam, and ice, we have left $9.50 profit per day. These figures are very conservative and allow for a considerable loss of steam and ice. For instance, 1 pound of $3 coal furnishes enough heat to produce about 8 pounds of steam in the average boiler. Approximately 152 pounds of steam at 75 pounds boiler pressure are required to raise 1,000 pounds of water from 60° F. to 212° F. To sterilize 2,000 pounds of water, or enough to wash 1,000 pounds of butter, therefore requires 304 pounds of steam. This according to the above requires 38 pounds of coal at $3 per ton, amounting to almost 6 cents. The figures for ice and labor are equally conservative. From this it is very evident that it is entirely practical and economical to sterilize wash water for butter, and butter so made is more wholesome for the consumers.

GRADING CREAM.[a]

The quality and hence the price of butter is affected to a considerable extent by the condition of the cream from which it is made. The question of paying for the butter fat in cream on the basis of quality has therefore arisen and is becoming more and more important with the increasing use of hand separators on the farm in certain sections of the country.

There are a number of advantages to the creamery patron in skimming his milk at home and delivering only the cream, such as the lessened expense in hauling and the increased value of the skim milk for feeding purposes. At the same time there are in practise certain disadvantages from the standpoint of the creamery manager, among which are the frequent use of unclean farm separators and the keeping of cream for long periods without proper cooling before delivery. This has often resulted in the manufacture of butter of inferior quality as compared with that produced under the whole-milk system.

With a view to improving the quality of cream from farm separators until ultimately the greater part of the cream delivered will make high-grade butter, E. H. Webster suggested as an initial step the grading of cream on the basis of acidity, and his recommendation was put into effect January 1, 1904, by a prominent creamery company in Kansas. The dividing line between grades 1 and 2 was placed at 15 cubic centimeters by Mann's acid test, and a difference of 1 cent per pound was made between the two grades.

Recently O. Erf has written a bulletin on this subject in which he says that cream has been graded in the dairy department of the

[a] Compiled from Indiana Sta. Bul. 104; Kansas Sta. Bul. 135; U. S. Dept. Agr., Bureau of Animal Industry Bul. 59, p. 42.

Kansas Agricultural College for nearly two years, and that the system employed has given universal satisfaction to the patrons and has produced a marked improvement in the quality of the cream. According to Erf, three grades should be established, depending upon the acidity of the cream, flavor and odor, age, and fat content. Cream to be of first grade should contain not more than 0.2 per cent of acid, have no undesirable flavors or odors, be not over three days old, and contain not less than 30 per cent of fat. Second-grade cream may contain as much as 0.3 per cent of acid, but should be untainted, not more than five days old, and should contain 30 per cent or more of fat. Third-grade cream may be somewhat stale and tainted and contain less than 30 per cent of fat. A difference in price of at least 4 cents per pound should be made between the first and second grades and 2 to 3 cents between the second and third.

USE OF PARAFFIN IN DAIRYING.[a]

This familiar wax-like substance obtained from crude petroleum, coal-bearing shales, and other sources has numerous practical uses. In connection with dairying particular mention might be made of the use of paraffin in coating cheese and butter tubs. In both cases its value depends mainly upon its waterproofing properties. For the same reason paper treated with paraffin is used extensively for wrapping purposes where it is desirable to prevent loss of moisture.

A few years ago the coating of cheese with paraffin was first tested experimentally. The results were so encouraging that the method was taken up by practical cheese makers and now has a widespread use. A large amount of data has accumulated to show that paraffining cheese tends to prevent the development of mold as well as the shrinking due to loss of moisture by evaporation. Some of the actual results obtained have already been noted in previous numbers of this series,[b] so it answers the purpose of the present note to state in a general way that paraffining cheese is an effectual and practical means of lessening or preventing loss of moisture so long as the coat of paraffin remains intact. The shrinkage prevented is generally more than sufficient to repay the cheese maker for the cost of material and the labor involved in paraffining the cheese.

In experiments in canning cheese at the Oregon Station the tin was very satisfactorily protected from the action of the salt and acid by coating with paraffin. This was done by placing a small amount of the paraffin in the can, heating it, and then revolving the can

[a] Compiled from Oregon Sta. Bul. 78; Utah Sta. Bul. 96; U. S. Dept. Agr., Bureau of Animal Industry Bul. 89.

[b] U. S. Dept. Agr., Farmers' Buls. 186, p. 31; 190, p. 17.

until the entire interior surface was covered with a thin layer. In similar experiments at the Utah Station the rusting of the cans was likewise prevented by coating the interior with paraffin.

Recently L. A. Rogers in a bulletin of the Bureau of Animal Industry of this Department shows that the paraffining of butter tubs will prevent the growth of molds on the inside, thus eliminating a very annoying trouble frequently met with by butter dealers.

The paraffin may be applied with a brush or a small quantity of the melted paraffin may be poured into the tub and the tub rotated until the entire surface is coated. The paraffin should be heated to a temperature of 250 to 260° F. The tub may be heated over a steam jet. A 60-pound tub may be satisfactorily coated with 3 ounces of paraffin, costing less than 2 cents. This cost is more than offset by reducing the loss by evaporation from the outside and the absorption of water from the butter by the tub. In some experiments it was found that 15 cents' worth of paraffin saved in this way the price of 6 pounds of butter.

Rogers summarizes the advantages of paraffin as follows: (1) Certain prevention of moldy tubs, (2) prevention of mold on butter and liner by avoiding air space, (3) neater appearance of tub, and (4) reduction of loss from shrinkage.

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